
CHAPTER 7

Regional Multimodal Traveler Information Center

7.1 BACKGROUND

The regional multimodal traveler information center is the transportation-management system's centralized source of road and transit information. The center is the focal point for information collection and dissemination. Each center's and agency's facility is just a part of the total regional transportation network covering all modes (road and transit), all types (freeways and arterials), and all areas (adjacent cities and counties). Operational decisions made by one agency impacts facilities operated by other agencies. It is important to collect and coordinate the information and response of different management and control systems by different centers and agencies. This requires interconnection of the traffic-management centers and the exchange of real-time data. Traffic-management centers need to be able to exchange real-time status data in order to monitor the condition of facilities under the management of other centers. In addition, the interconnection of centers needs to enable a computer or operator at one center to make changes in the operation of field devices managed by another center. Where decisions are made by one center, such as to change the signal-timing plans based on detector data, it is necessary that other affected centers implement actions in tandem with that decision. This requires the ability of one center to issue commands to other centers.

There is a need for a centralized source of real-time roadway and transit information to provide a comprehensive and integrated view of the road and traffic conditions throughout the metropolitan area or region. Potential users of this information include both the end users (e.g., travelers, traffic managers, transit operators, private sector transportation-intensive businesses) and the private sector value-added resellers of the information and related traveler services. This information repository may be either a centralized or an interconnected set of data management facilities that directly receive real-time information from the various roadway detection and surveillance systems and other information sources, either public or private. The Regional Multimodal Traveler Information Center combines this information, packages the information in a variety of formats, and provides the information to users through different distribution channels (e.g., telephone voice and data services, radio and television broadcasts, kiosks, HARs, computer-based Internet services, in-vehicle devices, DMSs, etc.). The information may be provided both directly to the public and to private sector information service providers that will supplement it with additional information, features, and services, and market the enhanced service products. The center links data provided by other advanced transportation systems into a comprehensive regional information system.

The Regional Multimodal Traveler Information Center is capable of providing automated feeds of traffic, transit, and other transportation-related information to the appropriate distribution channels. Basic information may be made available directly to communications outlets, (e.g., HAR) while specialized feeds to users are provided by private sector information service providers. The type and volume of information can be tailored to the user population, the type of distribution media employed, and the users' special devices (e.g., pagers, radios, telephones, in-vehicle navigation devices, etc.) for receiving and displaying that information. The Regional Multimodal Traveler Information Center provides/supports a level of data integration (fusion) to clearly reflect the status of the road network (travel times, environmental conditions, special events or conditions, etc.) and transit schedule information.

Metropolitan areas generally consist of multiple local jurisdictions and State-level organizations, each responsible for providing some level of traffic surveillance, management, and control. The Regional

Multimodal Traveler Information Center supports interjurisdictional coordination involving activities segments of the metropolitan area (e.g., HAZMAT incident response, special events, weather-related or maintenance operations, etc.). Managers of the traffic network, as well as the organizations efficiently coordinate plans when assisted by common access to the information within the Regional Multimodal Traveler Information Center databases.

Provider (ISP) subsystem; the Remote Traveler Support (RTS) subsystem; and the Personal Information Access System (PIAS). Traffic and transit data are input, processed, and stored by the ISP. The ISP managed in separate facilities). The other two subsystems, RTS and PIAS, request information from the ISP and provide it to the traveler.

provided by both public and private-sector entities. The ISP is capable of combining data from different sources, packaging the data into various formats, and providing the information to a variety

The RTS subsystem disseminates the information at fixed sites, such as transit stops, kiosks, shopping malls, and other public places. The PIAS subsystem disseminates traveler information in the home,

ture for a corridor-wide traveler information system was developed for the I-95 Corridor Coalition and can be found in Appendix K).

in-vehicle products) and provides analysis of its future potential. The following are summaries of market overview.

Advisory systems (i.e., systems consisting of all the features of autonomous systems such as vehicle navigation and destination directory-type information, as well as additional communica-

1995).

- with roadside beacon-based infrastructure to integrate latest traffic information, real-time, into the suggested route calculations), advisory systems are projected to account for an increasing per-
- In 1991, approximately 650 units were shipped throughout the United States and this quantity
- In 1991, the average system price was about \$2,500. In 1995, the price decreased to \$1,600.

- Market projections forecast a total estimated market of \$210 million in 2001, representing approximately 260,000 unit shipments per year.

Kenneth Orski (http://www.itsonline.com/ko_atis.html) discusses traveler information services as follows:

Live traffic reports on commercial broadcast radio are the most widely used medium to communicate with the traveling public. A 1993 University of California study revealed that 94 percent of motorists obtain traffic information from their home or car radio. Today, traffic information is broadcast commercially over 860 radio and TV stations in 54 cities to a listening audience estimated at 120 million. Commercial traffic information providers rely on state-of-the-art technology and a variety of information sources, including aerial surveillance, State and local police agencies, local traffic operation centers, and on-the-scene reports from passing motorists.

Commercial TV channels and cable TV are not far behind. Morning and afternoon TV news shows offer a steady stream of traffic reports, utilizing sophisticated graphics and live video. The viewing audience is estimated at 120-150 million.

The Internet has become another rich source of transportation-related information. "Commuter Pages" on World Wide Web have been set up by State and local transportation agencies in a number of metropolitan areas. The Web sites provide color-coded maps depicting traffic conditions. They are supplemented in some cases by still images of critical road segments from video surveillance cameras. Most Web pages also offer information about transit services and alert commuters about road detours and major incidents.

Workplace-based travel information systems are likely to become commonplace in the future. Their precursor is the Chrysler Tech Center Employee Network, an internal cable system that disseminates traffic information over 500 TV monitors located throughout the giant CTC facility. Congestion maps, obtained from the county-operated traffic-management center, are updated continuously, providing departing employees with up-to-the-minute reports on traffic conditions throughout the region and allowing them to determine the best route home — or postpone their time of departure in case of a major incident. Eventually, employees will also be able to access this information through their desktop computers

The public sector is also in the business of communicating travel information to the public. Examples include Montgomery County's (MD) traffic bulletins and live video images on the county's public access channel; Minnesota DOT's traffic reports broadcast over a public radio station; and Georgia DOT's statewide network of travel information kiosks. In addition, numerous State highway departments, toll road authorities, and airports beam service announcements to the driving public over Highway Advisory Radio (HAR) transmitters. Electronic dynamic message signs, utilizing modern LED technology, are employed extensively to inform motorists of traffic congestion and accidents ahead, hazardous road and weather conditions, road construction, and other safety-related conditions.

7.2 CASE STUDIES

The following case studies detail deployments and/or operational tests that apply state-of-the-practice and advanced technologies in Multimodal Traveler Information Systems.

7.2.1 WASHINGTON METROPOLITAN TRAVELER INFORMATION SERVICE (WMTIS)

Overview

The Washington Metropolitan Traveler Information Source (WMTIS) project implements a Regional Multimodal Traveler Information System that will become the source for a broad range of current real-time information on traffic and transportation conditions including congestion, speed and incident data, public transit data, etc. It is a regional system in that the participants form a coalition of transportation agencies and private partners throughout the region, and information will be collected, processed, and disseminated throughout the entire region. It is multimodal because it involves both traffic and public transit agencies and services. Through the Traveler Information Center with the central server and on-site operators, it will provide a complete variety of voice, data, video, and graphical forms of traveler information and deliver them on technology platforms ranging from no- or low-cost approaches, such as audiotext telephone, on-line services, and advertising-funded kiosks, to state-of-the-art in-vehicle devices and full-featured personal digital assistants. It allows participating transportation agencies to share information through a central source of transportation data collected from agencies throughout the region.

The Traveler Information Center serves as a clearinghouse for and disseminator of relevant information that can be used to improve agencies' operations. In addition, public agencies are able to take advantage of traffic data from the privately financed supplementary surveillance equipment deployed as part of this project, and use that information for real-time management and scheduling of their systems. It also stimulates a thriving market for traveler information services by making the information available to all potential service providers in the region. Independent Service Providers (ISPs) have equitable access to the real-time information, on a fee basis, and benefit from the open architecture and industry standards upon which the design is based.

The Washington Metropolitan Traveler Information Service program is a true public/private partnership in that a third of the project funding comes from private contributions. In addition, beyond three years of operation, the public agencies and traveling public will continue to receive the benefits of the system without any public sector funding; all systems will be operated as a profit-making business in which no public funding is required for continued operation.

Services to be Provided

The Technical Team developing this project laid out the elements of the WMTIS deployment as follows:

- A fully staffed Traveler Information Center will be developed, totally financed by private contributions, to receive and process travel data and to disseminate traveler information.

- A data gathering system that capitalizes on a combination of currently collected public sector data and a private data-collection network designed to fill the gaps in the public sector data collection network.
- A dissemination program consisting of the SmartTraveler audiotext, a telephone-based system that will service every citizen of the metropolitan area with access to a landline or cellular telephone; on-line services; commercial vehicle operations; broadcast media; and cable television capability.
- A public agency information-exchange network to improve incident-management procedures, relying on the Internet and the I-95 Corridor Coalition's Information Exchange Network.

The Traveler Information Center will contain the following hardware configurations and systems:

- Hardware and software necessary to gather data from public sector agencies in an automated fashion for compilation into the Traveler Information database. Existing software and databases will be used and built upon rather than developing new software for all efforts. Team members will provide their previously developed softwares under a license agreement.
- Systems required to allow public sector agencies to exchange information among themselves on a real-time basis.

Information delivery platforms needed to service the following Independent Service Provider categories.

- In-vehicle device;
- Personal digital assistants;
- Pagers;
- Interactive television; and
- Multimedia on-line services with full-motion video.

Public/Private Partnership

This project has been designed to have substantial coordination, data sharing, and cost sharing between all partners. The guiding principle for the system design is one in which "public and private funds are both employed, but there should be the absolute minimal use of public funds to create the system and all private financing once it becomes operational."

Dissemination of Information

The technologies used for dissemination of information include the following.

- Audiotext Service* - A telephone-based, multimodal Advance Traveler Information System that will disseminate up-to-the-minute, route-specific, on-demand information to travelers from both landline and cellular phones. Two similar systems have been implemented by SmartRoute Systems

and are operational in Boston, MA, and Cincinnati, OH. This service is designed to meet the need for basic travel information available to all income groups at no cost to the consumer. The service provides both pretrip and en-route dissemination. The Boston audiotext service currently receives five million calls per year. It has a huge installed base that includes practically all homes and offices, and 20 percent of all vehicles and all income levels. It is easy to use and requires very little or no training.

- b. *Radio Broadcast and Cable TV* - The Traveler Information Center will offer services to the radio and cable TV media from a privately financed facility. They will be paid for directly by the media outlets. The real-time traffic and public transit information provided by the public agencies will be available to any private firm for dissemination to the public. Numerous television and radio markets have the infrastructure to receive and distribute the information from the Traveler Information Center. Some markets have exclusive channels for travelers or community channels like the Cable TV channel used by the Montgomery County Advanced Transportation-Management Center. The television programming can be shown continuously for a traffic channel in homes, offices, parking garages, lobbies, etc., or it can be incorporated in other programming by broadcasters for traffic reports at regular intervals.
- c. *On-Line Services* - Internet services that have the capacity to carry very detailed information and can support personalized, interactive applications. Numerous independent service providers will undoubtedly take the opportunity to integrate this information with their own proprietary information and services and provide it to users. In Boston, for example, the on-line service provided by SmartRoute Systems through AOL's Digital Cities program is the most frequently utilized service within the program. These Internet on-line services will be supported by advertising revenues and will include such information as destination finding and route guidance, digital yellow page listings, and real-time information (e.g., traffic conditions, accidents, incidents, special events, weather conditions, road maintenance, and video images).
- d. *In-Vehicle Information/Navigation Systems* - device platforms have been developed to receive traveler information for en-route travel planning. Market research performed for the in-vehicle device manufacturers indicates consumers' strong desire to have this type of traffic information.
- e. *Commercial Vehicle Operations* - Advanced traveler information will be provided to commercial vehicles. Such a system will be similar to the Boston implementation and will include cellular phone, pager, two-way radio, and a mobile data terminal.
- f. *Personal Digital Assistants* - These devices are similar to the ones used in the Atlanta Traveler Information Showcase utilizing Hewlett-Packard palm-top computers interfaced with SkyTel two-way pagers. Map databases and software are stored on a SanDisk memory card. Features include: scheduling and planning functions, the SkyTel news report, two-way personal paging and two-way personal text messaging, travel destinations, on-request real-time traffic speed and incident data, traffic-dependent personal routing, transit information.
- g. *Kiosks* - Map-based information kiosks are being developed that can receive information from the Internet or FM subcarrier broadcasts. Also, travel information will be provided to kiosks being planned by participating public agencies. The kiosks will be placed in hotels and business lobbies,

visitor centers, and transportation terminals. Initially the Traveler Information Center will provide information to the independent service providers as a public service with longer term agreements to share revenues as these services become self-sustaining.

- h. *Wireless Communications to Portable and Fixed Computers* - Several wireless information providers (FM subcarriers, two-way paging, cellular telephone) will provide bundled wireless receiver/software products to enable owners of portable and fixed PCs to receive traveler information by plugging wireless receivers into a serial port on their computers. It will provide personal messaging, news, weather, real-time traveler information, plus other services. The wireless technology does not require the user to connect to a phone line. This same service can be used to provide information via kiosks as well as message signs located in public places. Just like the other services, the Traveler Information Center will receive a portion of the revenues generated by these products and services in exchange for the information provided to the independent service providers.
- i. *Personalized Paging* - Personalized paging services are offered whereby the regular travel and/or commute patterns of pager users are stored in the Traveler Information Center systems and the customers are individually paged to alert them of incidents or conditions that would affect their regular travel. This is similar to the personalized paging service being provided for the SWIFT system in Seattle, WA.
- j. *Interactive Television* - This is similar to the services being provided for the Atlanta Traveler Information Showcase where users (e.g., hotel guests, home cable viewers) are able to request real-time traffic and transit information from the television.

7.2.2 ATLANTA TRAVELER INFORMATION SHOWCASE

Overview

The Atlanta Traveler Information Showcase provides timely transportation information to travelers in the Atlanta metropolitan area through the use of personal communication devices, in-vehicle navigation devices, on-line computer information services, interactive television in selected hotels, and cable television. This information is available to both residents and visitors for trip planning purposes. The project was operational before, during, and after the 1996 Summer Olympic Games. The Traveler Information Showcase includes information on multimodal travel options, including bus, rail, and air travel.

Devices

a. *Personal Communications Devices*

The pen-based Envoy runs on General Magic's Magic Cap graphic operating system. Users touch icons on the Envoy screen with a stylus to access a map of Atlanta showing real-time traffic information, electronic yellow pages, and other services. Navigation Technologies supplies the map database and electronic yellow page database; Etak's map database and electronic yellow pages software is being integrated with Hewlett-Packard's HP200LX palm-top computer and SkyTel's two-way paging

network. The HP200LX runs on MS-DOS. The windows-like operating system guides users step-by-step through the pull-down menus and icons to access real-time traffic information, electronic yellow pages, and other services.

The user enters their query for specific information into their hand-held device, which transmits the request to the fixed-end server located in the Transportation Management Center in Atlanta. From its own data sources and the Georgia Department of Transportation's Advanced Transportation Management System computers, the fixed-end server retrieves the requested information and transmits it via dedicated phone lines to wireless data network or paging facilities where it is then broadcast back to the user.

Services provided include: traffic congestion and incident location and type; sites of scheduled road maintenance and construction activities (including project start and end dates and times); travel speeds and parking availability by locations; MARTA transit bus and train frequency, fares, and routes; schedules and locations for sporting and other events; wide area bus, train, and airline route and fare information; route guidance for automobiles; electronic yellow pages detailing information and locations of restaurants, hotels, theaters, museums, historical sites, shopping centers, automated teller machines, gas stations, hospitals, police and fire stations, emergency medical services and taxis.

All services are available throughout the greater Atlanta metropolitan area. Many of the functions reach throughout Georgia to cities like Athens, Savannah, and Columbus.

b. *In-Vehicle Devices*

Siemens provides the in-vehicle computer and the visual display unit. The computer unit, which includes the main processor, mass storage device, inertial gyroscope and dead-reckoning device, is mounted in the trunk of each vehicle; Navigation Technologies supplies the digitized map database and an electronic yellow pages and point of interest database; DCI delivers real-time traffic information to the vehicles via FM subcarrier broadcast. DCI also provides the radio receiver and antenna that allows the vehicle to receive the FM subcarrier broadcast.

The Showcase fixed-end server receives a constant stream of real-time messages on traffic congestion, incidents, planned and unplanned road maintenance, planned events, and parking lot capacity from the Georgia Department of Transportation's Advanced Transportation Management System database and network. This information is sent to DCI where it is formatted and transmitted to FM stations in the Atlanta metropolitan area. The information is transmitted via FM subcarrier technology to the vehicles equipped with the in-vehicle devices.

To use the system, the driver enters his/her destination into the visual display unit mounted on the dashboard. Because the vehicle's origin is determined by an on-board satellite-based global positioning system, the route to the chosen destination can be calculated automatically. The driver can also stipulate that certain conditions such as "maximize freeway use," or "shortest time travel" be factored into the system's computation of the route. The system allows the driver to choose between screens showing turn-by-turn route guidance or a map display of the area. On the turn-by-turn screen, an arrow will point left or right at the next turn and count down the distance to that intersection. An audio command will also alert the driver to an imminent change of direction. On the map screen, a triangle representing the vehicle will move along the programmed route, which is in brightly colored

overlay. Icons show locations in the coverage area where there are incidents or indicate traffic speed and parking lot capacity. A red "x" indicates that a road is closed.

Information transmitted to the in-vehicle device is updated every 90 seconds, depending on the volume of data being transmitted; DCI has agreements with five local FM stations that will give the system coverage in a roughly 100-mile radius around Atlanta.

c. *Cable Television*

Etak provides the map database and the system integration; Georgia Public Television distributes the traffic information programming to cable systems throughout the State via a digital satellite uplink.

The information available to viewers includes: maps with icons showing incident locations and color-coded segments that indicate traffic speeds, live surveillance video feeds from cameras placed along interstate highways and major arterials throughout the metropolitan area, and traffic advisory bulletin boards will form the backbone of the visual presentation. During peak morning and evening rush hours, a Metro Networks staff member is in a production room in the Georgia Department of Transportation's Transportation Management Center to narrate the live broadcast. This person is able to manually direct the system to pause on the video shot of a particular incident for an extended report.

The Showcase fixed-end server receives a stream of information from the Georgia DOT's Advanced Transportation Management System's video surveillance cameras, radar detectors, and other sensors. The information is processed in the Showcase fixed-end server for distribution to the cable TV programming system data server. Once the information has been processed, it is distributed to a multi-media computer that automatically calls up pregenerated broadcast quality maps and pairs them with live traffic video surveillance feeds. This final presentation is converted to a broadcast signal and transmitted to the Georgia Public Television's satellite transponder over a fiber-optic line for distribution to cable companies throughout the metropolitan area.

Following an opening segment, viewers see an overview map of Atlanta with color-coded highway segments that indicate the speed at which traffic is moving. A second overview map uses icons to place incident locations. A prerecorded message tells viewers what the color coding means and to stay tuned for more detailed information. The system reports individual incidents and provides a detailed incident location map as well as textual descriptions. Live video (if available) of the incident and narration that describes the nature of the incident follows the incident map. A scrolling text bulletin board provides special traffic and transit advisories.

d. *Interactive Television*

T Network, a Source Media company, provides the interactive computer system with the set top boxes and the remote control end-user units. Etak supplies the digitized map database and a data server at the transportation management center, which distributes real-time traffic information to the hotel interactive television system. The Crown Plaza Hotel, Ravinia, hosted the demonstration.

Guests use the remote control unit in their rooms to request information. Upon each television in the interactive television demonstration sits a set top box that is linked through the room's telephone line

to a head-end computer located in the hotel. This computer is linked with the Etak data server in the Georgia DOT's Transportation Management Center through a dedicated telephone line. The Etak computer receives a constant stream of traffic information from the Showcase fixed-end server, which is also situated in the TMC, processes the data and then distributes it to the hotel computer. The set top box receives the guest's request from a remote control for information and relays the message to the hotel head-end computer, which processes the inquiry and returns a multi-media response (maps, color slides, voice) for display on the television set.

Using the room's remote control unit, the guest signs onto the interactive channel. Choosing from a list of programming options from a graphical menu, the user pushes the number on his/her remote control unit that corresponds with the desired service. The system is designed in such a way that no user instructions are needed to determine how to navigate the system once the user is signed on.

The interactive programming menu includes:

1. Traffic incidents;
2. Highway speed;
3. Public transportation;
4. Special events;
5. Area attractions;
6. Restaurants;
7. Hotel services;
8. Weather;
9. Yellow pages; and
10. Tutorial.

By selecting "traffic incidents" on-screen, the viewer sees an overview map of Atlanta that is divided into nine zones. Incident locations are marked on the map by icons; highway segments are color-coded to indicate traffic speed. The viewer can use the remote control unit to specify a particular zone or corridor of interest. Incident icons are numbered, which allows the viewer to request a brief description of the incident printed as text along the bottom of the screen. By selecting "highway speed," the viewer sees an overview map of Atlanta with color segments and dots indicating current travel speeds.

Clicking on the Public Transportation tile, the guest can request MARTA and Cobb Community Transit bus and train operating hours and general transit information, wide-area travel information, and a list of MARTA and Olympic park-and-ride lots. When information is requested from the Yellow Pages function, the guest receives the name, address, phone number, and other pertinent information for each entry. The tiles Area Attractions and Restaurants present multi-media presentations that include

color pictures, audio, location maps, and driving and transit instructions to selected restaurants and points of interest in the Atlanta area. Guests requesting route guidance can have the information printed and can pick it up at the bell captain's stand in the main lobby. A printed map and instructions can be requested under Area Attractions, Restaurants and Yellow Pages services. The printout will be ready for pickup at the bell captain's stand.

e. *On-Line Services*

Several partners are involved in providing on-line services. Maxwell Labs has developed an Internet World Wide Web site. Navigation Technologies provides the map database for driving route planning support and yellow pages information services. MARTA provides the transit itinerary planning service.

The information provided includes: travel speed/congestion; real-time incident, maintenance, road closure information; MARTA and Cobb Community Transit bus and train service information; wide-area travel (Amtrak, airlines, Greyhound) information; planned public events; Atlanta-specific electronic yellow pages; auto and transit route planning support.

Maxwell Labs' Web server receives traffic data from the Showcase fixed-end server, both of which are located in the Georgia DOT's Transportation Management Center in Atlanta. The Showcase fixed-end server receives a continual flow of real-time traffic and transit information from Georgia DOT's Advanced Transportation Management System computers. Users request information through the Internet Web server, which relays data from Showcase fixed-end server. For instance, to receive route guidance, a user types in their origin and destination and then selects their mode of travel (drive, transit, intermodal). The routing directions are returned to the user in text format. Maps containing speed and incident information are generated by the Web server based on current traffic data received from the fixed-end server.

When users select real-time traffic information under the Transportation tile, a map of Atlanta with traffic speeds represented by color-coded segments and dots appears. Icons on the map pinpoint the locations of traffic incidents, maintenance, and planned events. A text description is provided if the viewer clicks on either a speed segment or an incident icon.

Other information that will be available on the Web site includes: the traveler newsletter, press releases, and other promotional materials; descriptions of the Showcase program, technologies and the participating government agencies and companies; hyper-text links with the participants' company home pages; and links with special events Web sites, as well as other transportation Web sites.

f. *Information Kiosk*

Partners involved in providing information kiosks include: the Georgia DOT, which provides project supervision; JHK & Associates, which integrated the system; Navigation Technologies, which provides the map database; GeorgiaNet Authority, which will maintain the entire system once it has been implemented.

When travelers request traffic and travel information, Advanced Transportation Management System servers respond to the query. The Showcase fixed-end server responds to non-traffic information

queries (Olympic Games park-and-ride lot status) only. The fixed-end server responds with data tables, which the kiosks process for specific usage.

The information available includes: real-time traffic speed and incidents by location; turn-by-turn automobile route planning support; MARTA bus and train schedules plus transit route planning; tourism information, including attractions, lodging information, and a hotel reservation system; weather forecasts; airline information; rideshare, vanpool, and park-and-ride options; special event information.

The kiosks are installed in transit stations, hotels, visitor centers, hospitals, airports, public and private office buildings, rest areas, and shopping centers in and around Atlanta.

Also, real-time traffic conditions will be displayed on a map of the Atlanta region with color-coded segments indicating traffic speeds.

The Showcase web site is <http://www.georgia-traveler.com>.

7.2.3 BOSTON SMART TRAVELER SYSTEM

Overview

In 1992, the Federal Highway Administration and the Massachusetts Highway Department awarded SmartRoute Systems a project called SmartTraveler, to provide real-time traveler information services.

Designed around a sophisticated network of live and slow-scan TV cameras located at crucial inter-sections throughout the metropolitan area, an elaborate network of regularly scheduled two-way radio and cellular phone probes, electronic scanners, fixed-wing aircraft, direct communication links with a number of public agencies, plus an evolving network of over-the-road traffic sensing technologies, the SmartRoute Systems Operation Center collects and manages real-time traffic, transit, and other related traveler information in a proprietary network of data fusion and dissemination technologies. Traveler information from the SmartRoute Systems database is presently sold and delivered to the public via landline telephone, cellular carriers, cable TV, traditional radio and TV, pagers, and now the World Wide Web and online providers. New delivery systems and joint marketing relationships are being developed for servicing personal digital assistants, alternative telephony providers, interactive television, and in-vehicle navigational devices.

SmartRoutes collects, processes, and delivers a broad range of traveler information to consumers through existing and evolving electronic media, including cellular phone, on-line services, paging devices, landline telephone, and cable TV. The system includes a fully staffed traffic operations center, and numerous stationary and rotating video cameras, which provide real-time information that is processed through SmartRoutes proprietary traffic-management software. This data, which is combined with information from electronic sensors, mobile probes, in-flight monitors, public highway and mass transit sources, and much more, is then available for dissemination through both public and private channels of communications.

Englischer et al (1996) assessed public acceptance of the information provide by SmartTraveler during its second year of operation in 1994. The evaluation showed the following:

- The number of calls averaged more than 3,000 on a typical weekday, while the number of individual users accessing the service during an average week was 7,500.
- SmartTraveler users were more likely to be making trips of more than 50 miles.
- Weather was the most important factor influencing people to call SmartTraveler before leaving work in the evening.
- Users are more likely to be male, to be over the age of 35, and to have annual household incomes exceeding \$50,000.
- Approximately two-thirds of users have access to cellular phones, compared with 30 percent of those in the target market.
- Cellular calls make up a disproportionate share of the SmartTraveler market (61 percent of the calls).
- More than 80 percent of users surveyed were "very satisfied" and less than 2 percent were "not satisfied."
- Users were most satisfied with SmartTraveler's ease of use, availability, and route coverage.
- Users were least satisfied with the attribute "suggestion of alternate route."
- SmartTraveler users ranked the service higher than broadcast media travel information on every characteristic surveyed.
- Many SmartTraveler users have decreased their reliance on the broadcast media for traveler information.
- All of the first-time users surveyed reported that they will call again, although more than two-thirds expected to call SmartTraveler fewer than five times per week.
- Most SmartTraveler users were extremely sensitive to cost: a hypothetical 10-cent charge per call caused respondents to reduce use of SmartTraveler by 36 percent; when asked about a flat monthly subscription of \$2.50, about half of the respondents said that they would be very unlikely to subscribe, and virtually none of the users would be willing to pay \$10.00 per month.
- Only 6 percent of the SmartTraveler users pay for the service now.

In a follow-up survey (1995) the following were observed:

- Cellular phone customers were given free service and the opportunity to dial using *1 instead of *ST1 previously used.
- SmartTraveler was receiving nearly 57,000 calls per week.
- Changes in the mix of calls from 1994 to 1995 were: conventional phone 39 percent to 16 percent; NYNEX cellular phone 57 percent to 43 percent; Cellular One 4 percent to 41 percent.

The SmartTraveler web site is <http://www.smartroute.com>.

7.2.4 ADVANCED REGIONAL TRAFFIC INTERACTIVE MANAGEMENT & INFORMATION SYSTEM (ARTIMIS)

The Greater Cincinnati and Northern Kentucky areas have implemented Phase One (called SmartTraveler) of ARTIMIS, a cooperative project of the Kentucky Transportation Cabinet (KTC), Ohio Department of Transportation (ODOT), and the Ohio/Kentucky/Indiana (OKI) Regional Council of Governments. SmartTraveler, like Boston's project, uses state-of-the-art technology to help local drivers avoid traffic tie-ups, facilitate smoother traffic flow through the area, and help reduce traffic accidents, fuel consumption, and hydrocarbon/nitric oxide emissions.

SmartTraveler, is a regional transportation information telephone service that began operation June 28, 1995. It provides 24-hour, up-to-the-minute, route-specific traffic information to travelers in the Greater Cincinnati/Northern Kentucky, I-275 beltway. One local phone call links travelers to a central traffic-management station where traffic managers operate a high-tech network of remote control cameras, radio- and cellular-phone-equipped drivers, aircraft, radio monitors, and computerized traffic data. Travelers can access information on traffic conditions anywhere within the I-275 loop via SmartTraveler by dialing 333-3333 from any touch-tone phone, or 311 from any mobile phone. The system's audio menu allows them to select specific information on any of the 16 travel routes within the area. They can also receive schedule information for Metro, TANK buses, Jetport Express airport shuttle service, RIDESHARE car pools and, where appropriate, travel alternatives.

SmartRoute Systems, Inc., of Cambridge, Massachusetts, provides the SmartTraveler System.

Estimated total cost for ARTIMIS: \$35 million, provided to the States of Kentucky and Ohio by the Federal Highway Administration via the Intermodal Surface Transportation Efficiency Act (ISTEA) of 1991's Congestion Mitigation and Air Quality (CMAQ) Improvement Program Funds. Kentucky and Ohio also provide State funds.

7.2.5 ADVANCED TRAVELER INFORMATION SYSTEM (ATIS) GRANT

On May 16, 1995, the North Dakota Department of Transportation (NDDOT), acting administratively on behalf of the University of North Dakota's Regional Weather Information Center, was awarded a \$750,000 Federal ITS grant for an "Advanced Traveler Weather Information System (ATIS)" Operational Test Project.

The project is a partnership between FHWA, North Dakota DOT, South Dakota DOT, the University of North Dakota, the National Oceanic and Atmospheric Administration, US West Communications, and other public and private partners, to apply the ATIS technology to the I-29, I-90, and I-94 corridors in North and South Dakota.

The goal of the project is to demonstrate how advanced technology in weather analysis, forecasting, and communication can be used to produce precise weather information for integration into an ATIS support system. Such integration is intended to produce safer and more efficient highway operations.

In FY 1996, the project received a \$1 million earmark from the U.S. House of Representatives.

7.2.6 HERALD EN-ROUTE DRIVER ADVISORY SYSTEM VIA AM SUBCARRIER

This operational test will disseminate important traveler information in difficult-to-reach, remote, rural areas (Iowa and Colorado) using a subcarrier on an AM broadcast station. System components — message generation, transmission, and reception — were developed by the multi-state organization Enterprise (which includes AZ, CO, IA, MI, MN, NC, WA DOTs, and the Dutch Ministry of Transport, Ministry of Transportation of Ontario). The project will determine system performance and analyze its impact on broadcasters, travelers, and equipment manufacturers. The primary objective is to assess real-world impacts of the system related to transmission of traveler information in challenging terrain (like that found in Colorado) and potentially interfering environmental conditions (such as those in Iowa), improvements to safety, and the overall marketability of the system.

7.2.7 HOUSTON SMART COMMUTER

Overview

This project aim of Houston Smart Commuter is to increase bus, vanpool, and carpool use by providing real-time traffic and transit information to travelers at home and work. Two components make up the Smart Commuter project.

1. The bus component encourages commuters to ride the bus instead of driving alone, focusing on the traditional suburb-to-downtown travel market in the IH 45 North corridor. Hardware and software for the transportation-information devices is in development and should be completed in April 1996. In-home information devices will be installed by April 1996 for each of the 700 test and control participants recruited. The operational test will begin in May 1996 and will last one year with semiannual evaluations.
2. The ridesharing component encourages commuters in the IH 10 West corridor to join carpools by using a ridematching service. METRO is integrating the rideshare system with its global information system map. System integration will be complete in early 1996; 2,500 drivers and ride seekers will be recruited in mid-1996.

The Federal Transit Administration, FHWA, Texas DOT, METRO and Texas Transportation Institute are partners in this test.

7.2.8 TRAV INFO

The TravInfo project developed and implemented a multimodal transportation information center to integrate transportation information from a wide variety of sources making it available to the general public, public agencies, and commercial (value-added) vendors in the San Francisco Bay Area. The Traveler Information Center (District 4, Oakland California) began operation for testing purposes in May 1996, and started live operations in September 1996. The comprehensive, region-wide traveler

information system supplies a broad array of devices and users with transportation information both before and during trips. System architecture is to remain “open-access” for all system aspects, to allow future growth and the transfer of technology.

TravInfo has access to the Caltrans Traffic Operations Center, the California Highway Patrol computer-aided dispatch system and other local data sources as well as the Transportation Management Center’s regional database on mass transit fares, schedules and routes. The TravInfo Traveler Information Center is public entity but operated under contract by Metro Networks, Inc. Metro is in charge of supervising the staff, operating and managing the data collection, fusion and dissemination processes of the TravInfo system, and supporting the necessary security and telecommunications systems.

TravInfo is sponsored by the Federal Highway Administration and Caltrans. It is being implemented through a partnership of public agencies, private firms and nonprofit organizations. It is led by the Metropolitan Transportation Commission, the regional transportation planning, financing and coordinating agency for the nine-county San Francisco Bay Area.

7.2.9 TRANSCAL

TransCal consists of three test projects: the Interregional Traveler Information System (IRTIS); the design and testing of a satellite-based Emergency Notification System for travelers to use to summon aid in emergency situations; and the Tahoe Frequent Passenger project which involves the unique use of smart cards, smart readers and a consumer incentive program to encourage the use of public transportation within the Lake Tahoe Basin.

IRTIS integrates and delivers road, traffic, transit, weather, and value-added traveler service information from across the entire region to fixed and en-route travelers via various user devices including telephones, personal digital assistants, in-vehicle navigation/display devices, and interactive kiosks. It showcases emerging capabilities in computing, communications, and consumer electronics that can improve the availability and quality of traveler information. The project assesses the ability to integrate information from multiple regions, and to integrate traveler services and transit information with real-time regional congestion and incident content.

IRTIS’ real-time traveler information database was created from data provided by California Department of Transportation Traffic Operations System, the California Highway Patrol, the Nevada Department of Transportation, the Nevada Highway Patrol and the National Weather Bureau.

TransCal has a computer-to-computer link with TravInfo and is capable of interfacing with other advanced traveler information systems. The TransCal Traveler Information Center, in Sacramento, is operated by Metro Network, Inc. The service operates along the I-80/US 50 corridor between San Francisco, CA, and Lake Tahoe/Reno, NV. A satellite-based MAYDAY system also provides low-cost coverage.

Traveler information is made available through three information channels that service four types of information access devices. The one most accessible to the general public is the Traveler Advisory Telephone Systems (TATS), which allows anyone with a touch-tone telephone to call a special number to get access to an audio version of current traveler information. Another way is to become a registered TransCal user and gain access through the Landline Data Service (LDS), which is for people who have a computer and a modem.

Participation by private sector firms, known as Value-Added Resellers (VARs), will further enhance the TransCal system. Companies willing to take part in the project as VARs will formally register as participants. These participants will generate their own information, as well as develop market products and services that utilize the TransCal data.

By Summer 1997, there will be at least eleven traveler information kiosks dispersed throughout the TransCal region allowing the general public to access the information. Each kiosk will disseminate traveler information for the entire TransCal region as well as information of local interest.

TransCal is sponsored by the Federal Highway Administration and Caltrans. It was created through a partnership of public agencies, private firms and nonprofit organizations.

7.2.10 YOSEMITE AREA REGIONAL TRANSPORTATION INFORMATION SYSTEM

The Yosemite Area Traveler Information (YATI) project, funded by the Federal Highway Administration and Caltrans, employs perhaps the largest and most diverse governmental partnership of any existing field operational test. It is a cooperative effort by local, state, and federal agencies to provide travelers with up-to-the-minute information about traffic and weather conditions, as well as the status of transportation and recreational facilities in the entire Yosemite region. Partners include Caltrans, the Federal agencies of the National Park Service, Forest Service, and Bureau of Land Management; and the county Regional Transportation Planning Agencies of Madera, Mariposa, Merced, Mono, and Tuolumne. In addition, a committee to ensure that local citizens' concerns about the project are heard and taken into account is in existence, as is a technical aspects advice committee.

Pretrip travel information is available through the use of a touchtone phone, personal computer, and/or multimedia kiosk. Travelers are able to obtain information on such diverse topics as mode options, regional road conditions, campground facilities, lodging, and tourist attractions prior to beginning their trip.

En-Route driver information provides portions of the same data via highway advisory radio, changeable message signs, and cellular telephone. Multimedia kiosks located at visitor centers and other tourist stops along the entrance corridors also provide en-route information to travelers. Thus, those who do elect to drive their own vehicles into the region can obtain up-to-date information that will enable them to make easier and more informed travel and itinerary choices.

7.2.11 DIGITAL DJ

Digital DJ, a San Jose startup backed by several Japanese manufacturers, will start broadcasting traffic data and other information in the San Francisco area. High-speed FM subcarrier technology already in use in Japan will allow participating radio stations broadcast data to receivers equipped with decoders and screen displays. Digital DJ will offer some services for free and others (including route guidance) on a subscription basis. Digital DJ will not lease broadcast capacity from radio stations but will assemble information on its own servers and disseminate customized subsets of that database to participating radio stations. The stations will receive the information on a "DDJ Workbench" computer that will reorganize it for local broadcast.

7.2.12 SHOWCASE INTERMODAL TRANSPORTATION MANAGEMENT AND INFORMATION SYSTEM (ITMIS) AND EARLY START PROJECTS

Traveltip

Traveltip, an Intermodal Transportation Management and Information System (ITMIS) project, developed and deployed under the Showcase initiative, was funded in fiscal year 1995 and will provide for an inter-regional multimodal advanced traveler information system in the Orange County region. The project will deploy technology used to improve traffic and transit operations, and provide information to transportation managers, travelers, and third-party users to enhance decisions on transportation management, route selection, and mode choice. Traveltip is a smaller version of what is envisioned for the entire corridor.

Four projects for the San Diego area have been identified and funded in fiscal year 1995 through the Showcase Early Start Program: (1) Transit Management Information System (Phase One); (2) Emergency Computer Assisted Dispatch; (3) Jack Murphy Stadium Traveler and Traffic Information System; and (4) San Diego Intermodal Transportation Management and Information System (Phase One).

7.2.13 SEATTLE WIDE-AREA INFORMATION FOR TRAVELERS (SWIFT)

Seattle Wide-Area Information For Travelers (SWIFT) is an advanced traveler information system operational test that was selected for implementation during 1994. The project team consists of the following members:

- Delco Electronics Corporation (General Motors Corp. subsidiary);
- ETAK, Inc.;
- Federal Highway Administration (FHWA);
- IBM Corp.;
- King County Dept. of Metropolitan Services;

- Metro Traffic Control;
- Seiko Communications Systems, Inc.;
- University of Washington; and
- Washington State Department of Transportation.

SWIFT is intended to provide an ATIS capability for the Seattle metropolitan area using a high-speed data (FM-subcarrier radio) system communicating to receiver devices capable of receiving the FM-subcarrier communications. These devices will receive a variety of traveler information types, including traffic advisories, personal pages, transit locations and schedules, and other relevant information.

The receiver devices being tested are:

- Delco radio receivers;
- IBM portable computers; and
- Message Watch™.

The portable computer devices will be capable of receiving a map display of current traffic information, bus positions and schedules, and rideshare information. The other planned devices will not support this capability.

The pertinent SWIFT data will be collected by a variety of organizations and processed (validated, integrated and/or fused and formatted) by the University of Washington. The data types being collected are freeway loop-sensor information, ride-share information, traffic advisories, incidents, scheduled events, bus locations and schedules, and personal paging messages, as well as differential global positioning satellite data. The processed data will be formatted and placed into message frames for transmission to the appropriate receiver devices.

The radio transmission system provides a wide-area capability that incorporates forward error correction and multiple transmission of data to increase the probability of correct reception of data. The system has a raw transmission rate of 19,200 bits per second, which after error correction and overhead provides usable information transmission rates of approximately 8,000 bits per second. If multiple transmissions of data are included, the final "real" information rate will be further reduced accordingly. Messages will be able to be individually addressed as in current pager systems, or group-addressed to a common set of receiver devices.

Plans call for the test to include a total of 700 devices, made up of 500 Seiko Message Watches™, 100 Delco radios, and 100 IBM portable computers. Users will be recruited to participate in the test, according to a plan developed by the evaluation contractor. A variety of technical performance, institutional, and user acceptance issues will be studied during this operational test.

7.2.14 BUSVIEW

Busview is a cooperative effort between King County Metro Transit, the University of Washington, and the Washington State Department of Transportation. It takes existing Metro bus AVL (automatic vehicle location) data combines it with a GIS (global information systems) map database and delivers real time bus location information in a graphical format to transit users over the World Wide Web.

7.2.15 RIDERLINK

Riderlink is a project that delivers a comprehensive collection of information to transit users, as well as car- and vanpoolers, over the Internet. Information includes transit route maps and schedules, ride-matching service, HOV (high occupancy vehicle) lane information and usage, and other information for those choosing non-SOV (single occupant vehicle) travel. An enhanced Riderlink project called the Easy Rider project will allow information from four transit agencies and the Washington State Ferries to be integrated into the system. Kiosks will be located at Boeing facilities, on ferry vessels, in ferry terminals, and at transit centers.

7.2.16 INFORMATION EXCHANGE NETWORK

Overview

The Information Exchange Network is a wide-area network of interconnected transportation management centers sharing real-time traffic information, but will also include transit, airports, rails, and motor carriers. The information that is to be exchanged among participating Coalition member agencies (e.g., New York, Philadelphia, Boston, Washington, D.C., Baltimore, Norfolk, Providence, and Hartford) include: incident management (e.g., exchange of real-time information on incidents and support of interagency incident-management activities); digital message signs and highway advisory radio (e.g., location, status and current messages); construction events (e.g., sharing information about existing as well as planned construction activities in the area); real-time traffic condition and status (e.g., volumes, speeds, occupancy, congestion levels, transit schedules, pavement conditions); historical data to be used for transportation planning, congestion-management systems, etc.; traveler information made available to the private sector (e.g., media, traffic reporting companies); commercial vehicle operations; and video sharing.

In a comprehensive study that was conducted by the I-95 Corridor Coalition to assess the user information needs, Patel and Kraft (1996) report on the survey (e.g., focus groups, individual interviews, phone surveys, mail surveys) results:

- Respondents consider information on weather conditions, traffic conditions, and construction activities and their locations as either very or somewhat important.
- More than 80 percent of the respondents consider information on construction, alternate routes, weather, and traffic conditions as either very important or somewhat important while they are en-route.

- More than 80 percent of the en-route respondents think that an in-vehicle system that warns of approaching hazards is either very or somewhat important to have. Also, 60 percent of the same survey respondents are willing to pay up to \$500 and \$1500, respectively, for in-vehicle emergency systems and automatic signal devices for help (MA AY
- For long-distance travelers, more than 80 percent considered information on weather and
tion on traffic conditions and directions either very or somewhat important during pretrip planning. For the en-route travelers, more than 90 percent thought that information on alternate
tion on traffic conditions.
- of arrival, traffic delays, and weather conditions.
- information.
- companies are responsible for providing this information.

SOURCES:

- *ITS Program of the I-95 Northeast Corridor Coalition*, April 15-18, 1996, Proceedings of the 1996 Annual Meeting of ITS America, Raman K. Patel, and Walter H. Kraft

7.2.17 MINNESOTA GUIDESTAR - TRILOGY

The Trilogy project is part of the Minnesota statewide ITS program, Guidestar. It will provide traveler information through different communications techniques: the Radio Broadcast Data System-Traffic Message Channel (RBDS-TMC) and a high-speed FM subcarrier. The primary objective of Trilogy is to test and compare a range of user devices and evaluate the potential improvements in efficiency of the existing transportation network. These devices will provide end-users with area and route-specific advisories on the highway operating conditions in the Twin Cities Metropolitan Area.

7.2.18 MINNESOTA GUIDESTAR - GENESIS

Genesis is an advanced traveler information system that uses Personal Communications Devices (PCDs) to distribute information. Timely delivery means gathering the data in real-time and distributing the data to travelers when they need it, where they need it, and how they need it. Genesis is an element in the Minnesota Guidestar ITS program. With transit and traffic data, Genesis is able to provide the urban traveler with current data relevant to a chosen trip mode and route. The Genesis PCD is portable and transit information is fully accessible to the user.

7.2.19 DENVER HOGBACK MULTIMODAL TRANSFER CENTER

This project will provide a multimodal transfer center on I-70 near the western edge of the metro area for travelers bound for the rural recreational areas west of Denver, as well as downtown Denver. Electronic methods will be used to provide real-time information to a kiosk for the traveler's use.

7.2.20 DIRECT

Driver Information Radio Experimenting with Communication Technology (Direct) is an operational field test that deploys and evaluates several alternative low-cost methods of communicating advisory information to motorists. These include use of the Radio Data System (RDS), FM subcarrier, automatic highway advisory radio, low-power highway advisory radio, and cellular phones. The Michigan Intelligent Transportation Systems (MITS) Center collects traffic information from various sources, fuses the information, and provides traffic advisory updates to travelers on an exception basis.

For more information on commuter response to real-time traveler information, see http://www.itsonline.com/c_resp.html.

7.2.21 TRAFFIC ASSIST

Traffic Assist is a private company providing real-time traffic information to users.

Users call the system via telephone, and receive routing instructions over the phone. There are several maps; one of them is the Los Angeles, CA, grid. Origin and destination locations are identified through numbers on the map. The system asks users to input the origin and destination of their intended travel. For example, if users wish to travel from LAX to Katella Ave. (off the 55 freeway), they select the corresponding numbers from the map. Number "2504" corresponds with LAX, and "1642" corresponds to Katella Ave. at the 55 freeway. After they key in those numbers, the system provides a set of directions that indicates the shortest time route at the time of the call. For example, the recorded voice might tell users to travel east on Century Blvd., south on the 405 San Diego freeway, east on the 105 Glen Anderson freeway, etc. The traveler is then informed of the total distance in miles and the estimated time en-route.

Traffic Assist can also send information to a pager or a PDA (portable digital assistant). They receive loop sensor data from just the freeway grid, and use historical profiles for arterial data.

For more information, see: <http://www.itsonline.com/tassist.html>

7.2.22 TRAVTEK

The INFORM project implemented in Long Island, New York, demonstrated that drivers will divert to less congested routes if presented with reliable and credible traffic congestion information. The project showed that 5 to 10 percent of freeway traffic can be diverted to appropriate off-ramps when neces-

sary, saving an estimated 300,000 vehicle-hours of travel; the ramp metering system has increased morning peak-period speeds by 3 to 8 percent.

To determine the usefulness of advanced in-vehicle navigation and information systems for drivers, Orlando launched the TravTek (Travel Technology) project. The test involved approximately 100 vehicles—mostly rental cars—equipped with electronic guidance systems. Some 4,000 drivers, the vast majority tourists, participated in the trial. The in-vehicle systems, loaded with databases, featured a navigation map showing all roads in a five-county, 1,200-square-mile area, as well as an American Automobile Association (AAA) Florida TourBook and Orlando tourist information on hotels, restaurants, attractions, and special events. Touch-screens allowed drivers to do everything from search for Italian restaurants to map the route from Orlando's airport to their hotels. Once a specific destination was selected, the system automatically calculated the best and fastest route to that destination, factoring in real-time traffic conditions.

On-screen maps displayed easy-to-follow, turn-by-turn driving directions for the prescribed route, along with the calculated distance and estimated travel time to the specified destination. Verbal instructions were also available to drivers, as were cellular phones for emergency help or additional information. Built-in magnetic compasses, satellite technology, and sensors in the wheels (to measure distance traveled) kept vehicles on their established courses. Thanks to the system's extreme ease of use, novices operated it fully after just a brief orientation.

Orlando has compared results from the TravTek trial to those of control tests in which drivers used standard printed road maps to find their way. Overall, the city found, TravTek reduced travel time by 19 percent—and helped drivers have fewer accidents. The hugely successful TravTek project, fully operational for one year ending March 1993 in Orlando, Florida, showed that drivers were receptive to (and enthusiastic about) in-vehicle, dynamic route-guidance devices. System use analysis showed that drivers using route suggestions provided by the system shortened travel times by up to 20 percent. Many users reported an easy transition to (and eventual reliance on) finding destinations electronically, without using paper maps. The TravTek experience has influenced private-sector development decisions, including marketing of in-vehicle devices now available as both new-car sales options and after-market installations.

7.2.23 TRAILMASTER

Trailmaster's advanced traveler information system provides accurate and timely information to motorists in the Phoenix area and throughout Arizona. Several local television stations use footage from cameras along the freeway during their traffic reports to show real-time traffic conditions, and travelers can call a toll-free number to get updates on road closures, construction, and weather information statewide. In addition, Trailmaster features an Internet Web site (www.azfms.com) that averages more than 23,000 hits a day. A map of the freeway system provides average traffic speeds and alerts travelers to areas of heavy congestion. Users can also click on a specific camera location to see a still-frame photo of the area's freeway conditions that is automatically updated every five minutes (ITS World, Jan/Feb 1997).

7.2.24 NEW YORK TRAVELER INFORMATION SYSTEM

New York City Transit (NYCT) is testing whether a traveler information system that provides real-time transit information can increase ridership. Real-time transit information will be generated from a GPS-based Automatic Vehicle Location (AVL) system. Under another project, NYCT is installing an AVL system on approximately 200 crosstown and uptown buses assigned to midtown Manhattan. NYCT is disseminating real-time transit information through four different kinds of traveler-information-systems devices. First, NYCT is installing 50 interactive kiosks at major bus stop transfer points and tourist locations. Second, NYCT is mounting 100 video monitors at major bus stops and storefront windows (e.g., banks, department stores, etc.). To comply with Americans with Disabilities Act (ADA) requirements, these monitors can also provide voice announcements. Third, NYCT is installing 100 electronic signs at major bus stops. Finally, NYCT is equipping 50 vehicles with message displays/interactive stations and annunciators for the visually challenged. Negotiations for the traveler information system are complete; however, final negotiations for the AVL and communications systems are still being conducted. These systems will be installed within two to three years. Until these systems are installed, the traveler information system cannot be deployed (September 1996).

7.2.25 TRANSMIT

TRANSMIT will provide a testbed for the application of Automatic Vehicle Identification to advanced traffic-management operations, from point-to-point journey time calculations and incident detection, through the origin-destination and traffic volume measurement. It is also enhancing the traffic-management tool to provide traveler information. Currently, traveler information services in the New York, New Jersey, Connecticut region operate independently of TRANSMIT. The ability to communicate with motorists is limited by the information capacity of the DMSs and directional insensitivity of the HAR. It is very difficult to tailor the information provided by these devices to the needs of the individual motorist. The integration of HAR and DMSs into the central computer system with the in-vehicle devices will enhance the traffic-management and traveler-information capabilities of the system. This will allow the system to automatically activate displays and information broadcasts based on detected traffic conditions. The New York Wide-area Information Network System (NY-WINS) will provide travelers with travel time from TRANSMIT, as well as incident and construction information from the TRANSCOM Operations Information Center and potential other traffic-management systems. TRANSMIT will use AVI transponders to provide two-way communication. Based on the data measurements, TRANSMIT will send specific information regarding traffic conditions back to vehicles equipped with transponders (K.R. Marshall and Brian Cronin, October/November 1996).

Etak and Metro Networks will develop the first nationwide real-time traveler information system. The system will transmit a variety of traffic and traveler information as it occurs to numerous products and services, including mobile PCS, video kiosks, message watches, cable TV, and other devices. Real-time traffic information will be available beginning with 10 metropolitan areas in 1997 (New York, Los Angeles, Chicago, San Francisco, Detroit, Atlanta, Seattle, Houston, and two others), an additional 20 in 1998 and 20 more in 1999, covering the major metropolitan areas throughout the country. The service will feature real-time reports that inform travelers of regional traffic incidents, traffic speeds, road conditions and construction, special events, weather conditions, etc.

Using FM subcarrier broadcasts and other distribution media, traffic information will be sent to a variety of wireless products and services, including vehicle navigation systems, portable notebook PCs, palmtop computers, pagers, and cellular phones. It will also be available for fixed devices, including home and office computers, via the Internet and cable TV, interactive TV, and electronic kiosks (The Urban Transportation Monitor, January 31, 1997).

7.2.26 TRAFFICONLINE

TrafficOnline, which provides customized, route-specific and point-to-point real-time information, is available in the Chicago metropolitan area, Atlanta, Boston, Detroit, Houston, Los Angeles, Minneapolis/St. Paul, New York, Orange County, Phoenix, San Diego, and Seattle. TrafficOnline provides significant advantages over existing Web page-based real-time traffic information services. It can be customized to a user's specific interests, thus providing more detailed information more efficiently, as only volume data is sent over the Internet. The shareware provides the ability to obtain travel time and other customized information. It provides customized, route-specific, and point-to-point real-time traffic information, including average speed, travel time, incidents, and construction information. In addition, a clickable real-time congestion map of major city highways, automatic warning of abnormal route travel times, and automatic update of real-time traffic information is available (The Urban Transportation Monitor, November 22, 1996).

Three southern California Area Traffic Reports are provided as a free Internet public service developed jointly by Maxwell Technologies Information Systems Division and Caltrans. The information service was designed to provide a graphical, real-time freeway traffic information tool to assist southern California commuters in navigating the freeway systems every day, 24 hours a day via the Internet.

Since these real-time, graphical traffic maps of southern California's freeway conditions first appeared live on the Internet, they have become one of the most popular Internet sites for Southland motorists. They are visited day in and day out by thousands of southern Californians who are interested in checking freeway traffic conditions for their commutes to and from work, sporting events, sales calls, concerts, business meetings, airports, train stations, etc. This information technology continues to garner strong technical accolades as an example of how useful public services can be when provided over the Internet. Freeway speeds are available for San Diego, Los Angeles, and Orange Counties. Incident reports, construction closures, and flow rates are available for San Diego County. General road conditions for the entire State are also available (www.scubed.com/caltrans/about.html).

7.2.27 FAST-TRAC

With more than \$70 million committed, the Faster and Safer Travel through Traffic Routing and Advanced Control (Fast-Trac) system is the largest operational test of intelligent transportation systems in the world. The program integrates advanced traffic management with advanced traveler information systems.

At the core of traffic management is the Sydney Coordinated Adaptive Traffic System (SCATS), which operates traffic signals in real time and adjusts them automatically to reflect changes in traffic flow,

incidents, and accidents. Video sensors enhance the data-gathering capabilities of the computer-based traffic-signal control system. (Oakland County chose video sensors over more conventional inductive loops for several reasons. For starters, the video devices can be installed on any surface and—important for Michigan—in any kind of weather. Also, one video camera can survey several traffic lanes at a time. Loop detectors, on the other hand, must be installed within roadways—tearing up pavement and restricting work to mild weather—and only one to a lane.)

At the traffic operations center, monitors display the overall traffic “picture,” including signal operations, information from video detectors, and congestion levels. Maintaining its own database of information, the system eliminates the need for traditional traffic-count studies and makes data instantly available for economic forecasts and other planning.

Fast-Trac has been successful on several fronts. At the World Cup soccer matches held in Detroit’s Silverdome—and since then, at major concerts and other special events—tests showed that the traffic-management system eased traffic flow and reduced the need for police to manually direct traffic.

Overall, the program is responsible for a 19-percent increase in rush-hour travel speed and a significant decrease in accidents. Studies suggest that Fast-Trac could potentially reduce the average number of vehicle stops by one-third, decreasing the incidence of rear-end collisions and slashing carbon monoxide emissions to the environment by 12 percent. Already, instituting a “leading” left-turn signal at intersections has reduced the number and severity of left-hand and head-on accidents; eventually, pedestrian priority signals at school crossings will minimize risks to children’s safety.

By making optimal use of its existing roadways, Oakland County is taking the fast track to a healthier community. The jurisdiction is saving money, attracting residents and businesses, and preserving its woodlands and lakes for future generations to enjoy.

7.3 EVOLVING TECHNOLOGIES

Call Box and Commercial Telephone

Call boxes are often installed along freeways to provide motorists a means of calling for assistance. They are also used for incident detection to inform the operating agency of the incident and its nature. Call boxes now have become multitasking, used not only for motorist aid but also for the acquisition and transmission of traffic data and weather and environmental data. Other capabilities include: full duplex voice capability; the ability to transmit and receive digital data; and detection and processing of real-time traffic information.

Internet

Using the Internet to disseminate real-time traffic information is a new application of the technology. The Internet world-wide computer network is a cost-efficient means of disseminating traffic information to the public. Access to the Internet is available to any personal computer user with an Internet connection. Dial-up connections can be obtained for home use by local Internet providers for a

minimal monthly fee. Dissemination of real-time traveler information (textual, graphical, and/or photographs) via the Internet is being accomplished by many public agencies across the country. Such traveler information includes graphical representations of freeway networks depicting real-time speeds (color-coded), real-time snapshots showing existing traffic conditions taken from CCTVs, real-time weather conditions, incident locations, scheduled construction and maintenance roadway closures, and transit schedules.

Intranet

The Intranet is very accessible in most large companies that already are connected electronically via a Local Area Network (LAN). A LAN links dozens or even hundreds of desktop computers in an internal network so employees can communicate with one another, share information, and access common databases. The Intranet, using LAN infrastructure already in place and employing the same standards and protocols as its more famous cousin, the Internet, is the internal version of the World Wide Web. But, whereas the Internet comprises an open network of Web sites that anyone with a computer is free to access and download, the Intranet is a network turned inward, protected from the outside world by an electronic firewall. Intranets are used for a variety of corporate purposes. Their Web sites contain corporate databases, announcements (electronic bulletin boards), manuals, company policies and procedures, directories, schedules, and internal correspondence. The use of Intranets is limited only by the needs and imagination of their corporate sponsors. One of the more inventive uses of the Intranet is the communication of real-time traffic information.

An example of Intranet use is found in the Fast-Trac TV system deployed at the vast Chrysler Technology Center in Auburn Hills, Michigan. The data from the Fast-Trac system is transmitted to a traffic operations center where a central computer automatically adjusts traffic signals throughout the network to optimize traffic flow and minimize delays at intersections. The data also provides a foundation for a traveler information system. The traffic operations center's computer generates color-coded maps, known as Fast-Trac TV, that depict in real time the state of congestion on Oakland County's streets and alerts motorists of traffic bottlenecks and major highway incidents. Initially, TOC's traffic surveillance capability was limited to Oakland County's arterial road network. Recently, the TOC has been linked to Michigan DOT's freeway surveillance system (MITS) which covers 32 miles of central Detroit's freeway network and will eventually be expanded to monitor an additional 150 miles of freeways in the Detroit metropolitan area. Today, Fast-Trac TV is the only system in the nation that depicts traffic conditions on a combined arterial-freeway network.

Realizing the potential value of this information to commuters, the Traffic Improvement Association of Oakland County (TIA), representing local employers and other business community interests, brokered an arrangement between the Road Commission and Chrysler Corporation to provide Fast-Trac TV to the 10,000 employees at the Chrysler Technology Center (CTC) in Auburn Hills. The signal is transmitted by a modem to the Tech Center and then, using specially developed software, converted and disseminated over CTC's cable network to more than 500 TV monitors located throughout the giant CTC facility. Maps are updated continuously, providing departing employees with up-to-the-minute reports on traffic conditions throughout the region and allowing them to determine the best route home—or postpone their time of departure in case of a major incident.

The computer-generated congestion maps are supplemented by text messages alerting home-bound employees to major incidents, road closures, construction detours, and hazardous road conditions. Eventually, this information will also be accessible through employees' desktop computers, and may include an icon that automatically alerts users of unusual traffic conditions along their customary itinerary, which has been preprogrammed into their individual computers. Eventually, Fast-Trac TV will be expanded to neighboring facilities in the Oakland Technology Center and is expected to reach an estimated 40,000 employees (Kenneth Orski, www.itsonline.com/ko_int.html).

Leased Cable Television (CATV)

Through public/private partnerships between transportation agencies and local cable companies, CATV has been used to broadcast live video from freeway surveillance cameras to trip planners. Prior to starting their trips, potential motorists can view real-time traffic conditions on their cable TV at home. They then can make decisions as to what route to take, what mode of transportation to take, or whether or not they should delay their departure.

Kiosks

The kiosk is a combination video monitor/computer mounted in a stand-alone cabinet that allows travelers to interact and retrieve requested information via touch screens or mouse. Various applications of kiosks include:

- Real-time displays of the freeway conditions map.
- Access to commuter transportation services.
- Routing and itinerary services.
- Carpool ridematching.
- Customized mass transit directions, including fares, times, route numbers and connections.
- Up-to-the-minute travel information including details of traffic bottlenecks and airline delays.

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